PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
B65B 5/02, B31B 5/80, B65B 21/02

A1

(11) International Publication Number: **WO 99/14120**

(43) International Publication Date: 25 March 1999 (25.03.99)

(21) International Application Number: PCT/US98/19606

(22) International Filing Date: 21 September 1998 (21.09.98)

(30) Priority Data:
9719954.1 19 September 1997 (19.09.97) GB

(71) Applicant *(for all designated States except US)*: THE MEAD CORPORATION [US/US]; Courthouse Plaza, Northeast, Dayton, OH 45463 (US).

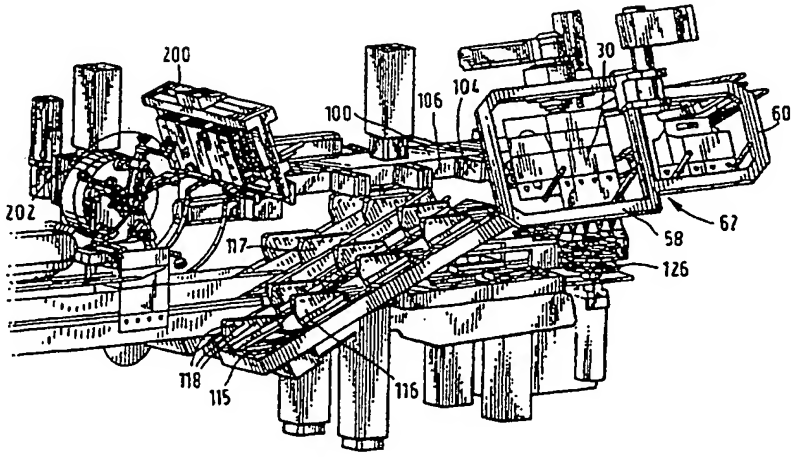
(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: BONNAIN, Jean-Christophe [FR/FR]; 14, rue du Marechal Juin, F-36000 Chateauroux (FR). DUSSART, Jean-Jacques [FR/FR]; Appartement 44, 5, rue de la Bievre, F-36000 Chateauroux (FR). EBLIN, Philippe [FR/FR]; Le Petit Valencay, F-36250 Saint-Maur (FR).

(74) Agents: DREW, Michael, V. et al.; The Mead Corporation, 4850D North Church Lane, Smyrna, GA 30080 (US).

(81) Designated States: AU, BR, BY, CA, CN, CZ, EE, HU, ID, IL, JP, KE, KR, LT, LV, MX, NO, NZ, PL, RO, RU, SG, SK, TR, US, VN, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: A PACKAGING MACHINE



(57) Abstract

A packaging machine for packaging articles into cartons selected from, at least, a first carton or a second carton is described, wherein the first and second cartons are of a different type or size. The cartons are stored in at least one hopper, and picked for packing by a carton engaging means arranged to remove cartons from said at least one hopper and transport them sequentially to a first predetermined position. From there the cartons are transferred to a paper feed chain which transports the cartons to a second predetermined position, from where the cartons are combined with said articles. The paper feed chain comprises a support means carrying a first endless chain from which is depended a first set of guide lugs and a second endless chain from which is depended a second set of guide lugs. The guide lugs are interleaved to produce carton receiving zones, the length of which can be altered, for different carton sizes or types, by altering the relative positions of the first and second set of guide lugs. The support means is movable such that when the relative positions of the lugs is changed, this change can be compensated for such that the position of the first set of lugs with respect to said first predetermined position is unaltered.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania
AM	Armenia
AT	Austria
AU	Australia
AZ	Azerbaijan
BA	Bosnia and Herzegovina
BB	Barbados
BE	Belgium
BF	Burkina Faso
BG	Bulgaria
BJ	Benin
BR	Brazil
BY	Belarus
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CN	China
CU	Cuba
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
GE	Georgia
GH	Ghana
GN	Guinea
GR	Greece
HU	Hungary
IE	Ireland
IL	Israel
IS	Iceland
IT	Italy
JP	Japan
KE	Kenya
KG	Kyrgyzstan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
KZ	Kazakstan
LC	Saint Lucia
LI	Liechtenstein
LK	Sri Lanka
LR	Liberia
LS	Lesotho
LT	Lithuania
LU	Luxembourg
LV	Latvia
MC	Monaco
MD	Republic of Moldova
MG	Madagascar
MK	The former Yugoslav Republic of Macedonia
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
MX	Mexico
NE	Niger
NL	Netherlands
NO	Norway
NZ	New Zealand
PL	Poland
PT	Portugal
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SG	Singapore
SI	Slovenia
SK	Slovakia
SN	Senegal
SZ	Swaziland
TD	Chad
TG	Togo
TJ	Tajikistan
TM	Turkmenistan
TR	Turkey
TT	Trinidad and Tobago
UA	Ukraine
UG	Uganda
US	United States of America
UZ	Uzbekistan
VN	Viet Nam
YU	Yugoslavia
ZW	Zimbabwe

A PACKAGING MACHINE

This invention relates to a packaging machine for packaging primary articles such as cans and bottles into multiple packaged cartons and in particular to a packaging machine which can package primary articles into cartons selected from two or more sizes or types of carton

The majority of known packaging machines are dedicated machines which construct only one size of one type of carton. Therefore, modern bottling plants are required to use a plurality of packaging machines to package different carton types, each machine taking up considerable floor space and being expensive to both purchase and operate.

A limited number of packaging machines are capable of packaging different sizes or types of carton, for example six, eight or twelve packs of a wrap around carton. All such machines require adjustment when switching from one size or type of carton to another. This adjustment includes the manual removal of all of the cartons within the packaging machine and possibly the mechanical adjustment of components in the machine. During this change over period, which can be thirty minutes or more, a machine cannot be used (known as "down time"), which is an expensive delay in a bottling plant. Such a delay may even result in down time for the entire bottling line, not just the packaging machine, if problems arise during the change over procedure.

It is an object of the present invention to provide a packaging machine which overcomes the technical and commercial disadvantages of known packaging machines.

It is a further object of the present invention to provide a packaging machine which is capable of switching from one carton type or size to another with a minimal down time.

According to a first aspect of the present invention there is provided a packaging machine for packaging articles into cartons selected from, at least, a first carton or a second carton, said first and second cartons being of a different type or size, said cartons being stored in at least one hopper, and picked for packing by a carton engaging means arranged to remove cartons from said at least one hopper and transport them sequentially to a first predetermined position, from where the cartons are transferred to a paper feed chain which transports the cartons to a second predetermined position, from where the cartons are combined with said articles,

the paper feed chain comprising a support means carrying a first endless chain from which is depended a first set of guide lugs and a second endless chain from which is depended a second set of guide lugs, said guide lugs being interleaved to produce carton receiving zones, the length of which can be altered, for different carton sizes or types, by altering the relative positions of the first and second set of guide lugs, and the support means being movable such that when the relative positions of the lugs is changed, this change can be compensated for such that the position of the first set of lugs with respect to said first predetermined position is unaltered.

Preferably, the relative position of the first and second sets of guide lugs is arranged by control of the motor which power one of the first and second endless chains.

Preferably, the position of said support means is arranged by the control of a pneumatic cylinder which positions said structure.

Preferably, the packing means comprises a control means which controls the operation of each of the components of the machine during operation and change over between cartons of different type or size.

Preferably, the packing means comprises a first hopper for storing said first cartons, and a second hopper for storing said second cartons, and transfer means to transfer the cartons from either hopper to said first predetermined position, said carton engaging means being operable in a first position for engaging cartons from the first hopper and a second position for engaging cartons from the second hopper.

Preferably, the packing means comprises means to place one of said hoppers in an operative position and control means to select the position of carton engagement means corresponding to the operative hopper selected.

Preferably, said carton pick up and transfer means is rotatable about a fixed axis in an orbital path.

Preferably, the first and second pick up positions are located at different points on said orbital path.

Preferably, the packing means comprises means to place one of said hoppers in an operative position in the form of a frame mounted to a second fixed axis and wherein said first and second hoppers are mounted to the frame each hopper being oppositely disposed about the second fixed axis.

Preferably, said operative hopper is adjacent the orbital path of said carton pick up and transfer means.

Preferably, the packing means comprises an apparatus for sequentially manipulating out of said at least one hopper collapsed cartons having oppositely disposed face contacting panels and for initiating set up thereof into an open ended condition, said apparatus being operable with said carton engaging means which sequentially engaging one of said face contacting panels and for withdrawing from the hopper a collapsed carton which includes said one of said face contacting panels

and transferring orbitally about a rotatable axis from said hopper to said first predetermined position, wherein said apparatus includes panel engagement means disposed outside the path of orbit for engaging the other of said face contacting panels so as to pull said other face contacting panel in a direction away from the carton pick up means thereby to initiate opening of the carton.

Preferably, the panel engaging means is moved in a first plane by a linear servo motor.

Preferably, said panel engaging means is mounted to a slide member in a substantially perpendicular relationship with a guide rail and wherein said slide member is moveable relative said guide rail whereby said panel engaging means is moveable in two planes.

Preferably, said panel engaging means is moved in a second plane by a further linear servo motor.

Preferably, control means are arranged to control the movement of the panel engaging means.

Preferably, said panel engaging means comprises a suction cup and cup holder mounted onto said slide member, said suction cup being connected to a vacuum supply during said carton opening.

Preferably, said face contacting panels comprise opposition side walls of the carton.

Preferably, the packing means has an article feed means arranged to progress articles at a predetermined rate along a feed path for combination with cartons at a measured rate.

Preferably, the article feed means includes a pair of star wheels which collect articles from a first feed belt and move them to a second feed belt at said predetermined rate.

Preferably, gripper blocks are arranged on opposite sides of said second feed belt to collect a predetermined number of articles and arrange them as an individual unit for packaging into a carton.

According to a second aspect of the present invention there is provided a method of packaging articles into cartons comprising the steps of:

a) selecting from, at least, a first carton or a second carton, said first and second cartons being of a different type or size, said cartons being stored in at least one hopper;

b) picking cartons for packing using a carton engaging means arranged to remove cartons from said at least one hopper and transport them sequentially to a first predetermined position;

c) transferring said cartons to a paper feed chain which transports the cartons to a second predetermined position from where the cartons are combined with said articles, the paper feed chain comprises a support means carrying a first endless chain from which is depended a first set of guide lugs and a second endless chain from which is depended a second set of guide lugs, said guide lugs being interposed to produce carton receiving zones, the length of which can be altered, for different carton sizes or types;

d) altering said length by altering the relative positions of the first and second set of guide lugs; and

e) moving the support means when the relative positions of the lugs is changed, so as to compensate for said change, such that the position of the first set of lugs with respect to said first predetermined position is unaltered.

Preferably, the relative position of the first and second sets of guide lugs is arranged by control of one of the motors which power the first and second endless chains.

Preferably, the position of said support means is arranged by the control of a pneumatic piston which positions said structure.

Preferably, the method comprises the use of a control means which controls the operation of each of the components of the machine during operation and change over between cartons of different type or size.

Preferably, the carton engaging means is positioned for engagement with cartons from a first hopper in a first position and is positioned for engagement with cartons from a second hopper, in a second position, the carton engagement means being movable between said first and second positions.

Preferably, the method comprises placing one of said hoppers in an operative position and selecting the position of the carton engagement means corresponding to the operative hopper selected.

Preferably, the method includes rotating said carton pick up and transfer means about a fixed axis in an orbital path.

Preferably, the first and second pick up positions are located at different points on said orbital path.

Preferably, the method comprises mounting said first and second hoppers on a frame such that each hopper is oppositely disposed about a second fixed axis.

Preferably, the method includes the location of said operative hopper adjacent the orbital path of said carton pick up and transfer means, when in use.

Preferably, the method comprises sequentially manipulating out of said at least one hopper collapsed cartons having oppositely disposed face contacting panels and initiating set up thereof into an open ended condition, by sequentially engaging one of said face contacting panels and withdrawing from the hopper a collapsed carton which includes said one of said face contacting panels and transferring orbitally about a rotatable axis from said hopper to said first predetermined position, wherein panel engagement means is disposed outside the path of orbit for engaging the other of said face contacting panels so as to pull said other face contacting panel in a direction away from the carton pick up means thereby initiating opening of the carton.

Preferably, the method includes moving the engaging means in the first plane by a linear servo motor.

Preferably, said method includes mounting said panel engaging means to a slide member in a substantially perpendicular relationship with said guide rail and moving said slide member relative said guide rail whereby said panel, engaging means is moveable in two planes.

Preferably, said panel engaging means is moved in a second plane by a linear servo motor.

Preferably, the method includes the use of control means arranged to control the movement of the panel engaging means.

Preferably, the method includes the use of said panel engaging means which comprises a suction cup and cup holder mounted onto said slide member, and the connection of said suction cup to a vacuum supply during said carton opening.

Preferably, said face contacting panels comprise opposite side walls of the carton.

Preferably, the method comprises the use of article feed means to progress articles at a predetermined rate along a feed path for combination with cartons at a measured rate.

Preferably, the method comprises the use of a pair of star wheels to collect articles from a first feed belt and move them to a second feed belt at a predetermined rate.

Preferably, the method comprises the use of gripper blocks on opposite sides of said second feed belt to collect a predetermined number of articles and arrange them as an individual unit for packaging into a carton.

According to a third aspect of the present invention there is provided a control means for a packaging machine as hereinbefore described, the control means comprising a central processor , a manual input means, and separate means controlled by said central processor for individually positioning the first and second sets of guide lugs and the support means carrying said guide lugs on the paper feed chain.

Preferably, the means for positioning the support means is a pneumatic cylinder.

Preferably, the control means is arranged for use with a packaging machine having two hoppers accessed by a single carton engaging means, wherein the control means comprises a means of positioning the carton engaging means in a first position for engaging cartons in said first hopper and a second position for engaging cartons in said second hopper.

Preferably, the means for positioning the carton engaging means is operable to position the engaging means in a third position, from which the carton engaging means cannot engage cartons in either hopper.

Preferably, said means is a pneumatic cylinder.

Preferably, the control means is arranged for use with a packaging machine having an opening means for opening cartons picked from each hopper, wherein the locus of motion of pick means on said opening means can be altered so that the opening means can open cartons picked from either hopper.

Preferably, control means comprise X and Y oriented servo motors.

Preferably, the control means is arranged for use with a packaging machine having an article feed means in the form of a star wheel, the control means controlling the speed of rotation of the star wheel.

Preferably, control means controls a motor which rotates the star wheel.

According to a fourth aspect of the present invention there is provided a control system for controlling the operation of a packaging machine, in order to change from first cartons in a first hopper to second cartons in a second hopper, comprising the steps of:

a) stopping the carton engaging means from picking any cartons;
b) continuing the paper feed chain until it is empty of cartons;
c) stopping the paper feed chain;
d) stopping the supply of articles;
e) repositioning the carton engaging means and the hoppers to enable picking from the alternative hopper;
f) altering the relative position of the first and second sets of guide lugs in said paper feed chain;
g) altering the position of the support means with respect to said first predetermined position; and

h) re-starting the carton picking and transportation process and the supply of articles.

Preferably, the instruction to changeover is read from a pre-entered control program.

Alternatively, the instruction to changeover is manually entered into a control means.

Preferably, the packaging machine has a means for opening cartons, which is also stopped during the changeover process.

Preferably, the locus of movement of a pick means in said carton opening means is altered prior to restarting to enable the means to open cartons from said alternative hopper.

Preferably, the pick-up point and locus of the pick means in the carton engaging means is altered during the changeover to enable picking of cartons from the alternative hopper.

Preferably, the speed of supply of articles is alterable as required depending on the size or type of cartons in each of said hoppers.

Preferably, the relative positions and state of motion of each of the movable components is sensed using individual sensors and transmitted to the control means.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURES 1a and 1b are perspective views of a basket type carton suitable for use with the machine according to the invention in its blank and open forms;

FIGURE 2a is a perspective view of a fully enclosed carton blank suitable for use with the machine according to the invention;

FIGURE 2b is a perspective view of an erected and loaded carton of the type illustrated in Figure 2a in its blank form;

FIGURE 3a is a perspective view of a wrap around carton blank suitable for use with the machine according to the invention.

FIGURE 3b is a perspective view of an erected and loaded carton of the type illustrated in Figure 3a in its blank form.

FIGURE 4 is a perspective view of the infeed of a packaging machine illustrating particularly the hopper unit, feed mechanism and paper feed chain;

FIGURE 5 is a perspective view from the opposing side of the packaging machine of Figure 4;

FIGURE 6 is a perspective view illustrating the hopper unit in a first position;

FIGURE 7 is a perspective view illustrating the hopper unit in a second position;

FIGURE 8 is a perspective view of the feeder of Figure 4;

FIGURE 9 is an exploded view of the feeder of Figure 4;

FIGURE 10 is a perspective view of the vacuum feeder, back feeder and paper feed chain of Figure 4;

FIGURES 11, 12 and 13 are further representations of the apparatus of Figure 10;

FIGURES 14 and 15 illustrate graphs showing the position, velocity, acceleration and denied acceleration plotted against time of the X and Y servo motors arranged to move the back feed of Figures 10 to 13;

FIGURE 15 is a plan view of an article feed means;

FIGURE 16 illustrates the downstream end of the packaging machine of Figure 4.

FIGURE 17 is a block diagram of a control means in accordance with the present invention;

FIGURE 18 is a flow diagram of a control system in accordance with the present invention.

A mechanism according to the present invention is capable of erecting a variety of carton type for example, wraparound, fully enclosed and basket type cartons. Any reference in this specification to carton type includes different sizes of a particular carton style. For example, the mechanism can load fully enclosed cartons for eight or twelve articles.

Referring to the drawings, and in particular Figures 1a and 1b thereof, carton 10 is a basket type carrier shown in Figure 1b in a set up condition ready for lowering onto articles. The carton 10 includes opposed side wall panels 12, 14 and opposed end wall panels 16, 18 hingeably connected one to the next. The carton further includes a handle structure which inter-connects end wall panels 16, 18 and comprises transverse partition panels 22 inter-connecting each side wall 12,

14. Base panels 24, 26 are hingeably connected to each side wall panel 12, 14 respectively.

Referring now to Figure 2a and 2b of the drawings there is illustrated a wrap around carton 30, shown in Figure 2a in its flat collapsed form. The carton blank includes opposed side wall panels 32, 34 and opposed end wall panels 36, 38 hingeably connected one to the next. The carton further comprises top panels 40, 42 and base panels 44, 46 hingeably connected to respective side walls 32, 34. Articles are inserted into the carton from above or, as the case may be, from below and the top and base panels are then secured together to provide a fully enclosed carton.

As illustrated in Figures 3a and 3b, carton 31 is a wrap around type carton, shown in Figure 3a in its blank form. A carton blank 31 includes first base panel 33, side wall 35, top panel 37, second side panel 39 and base panel 41 hingeably connected one to next. Top panel 37 comprises three pairs of apertures 43, 45 spaced between the side edges of top panel 37 and adapted to receive upper portion of articles A, illustrated in Figure 3b.

It is envisaged that the cartons can vary depending upon the shape and or quantity of articles to be packaged and accordingly, a machine in accordance with the present invention is adjustable in numerous respects so that it can process a wide variety of such cartons. The principal arrangements which are likely to be varied are shown in Figures 1a, 2a and 3b in which "H" is the overall height of the set up carton equivalent to the distance between the upper edge of the side wall and base panel, and "L" is the overall length of the carton when the base panels have closed.

Referring to Figures 4 to 7 of the drawings there is shown a packaging machine 50 for processing cartons, for example, of the type outlined above. The upstream end of the machine includes a dual hopper 52 in which a multiplicity of

basket type and fully enclosed cartons 10, 30 in a collapsed condition are held ready for processing.

The hopper unit 52 (Fig 6 and 7) comprises two (or more) separate hoppers 58, 60 in adjacent positions. Each hopper 58, 60 is mounted onto a frame 62, as shown in Figure 6 and 7. The frame 62 is mounted onto a main shaft 64 which can be rotated about axis X - X. Each hopper 58, 60 is a gravity feed type whereby the carton blanks are held in their respective hoppers at an incline to provide a positive feed. It is envisaged that the hopper units could comprise any number of hoppers adapted to receive different carton types or sizes encircling the rotary feeder hereinafter described.

In this embodiment, a n pneumatic cylinder (not shown) is used to rotate the frame between two positions: the first position, as shown in Figure 6, with the first hopper 58 placed in an operative position ready for fully enclosed cartons held in the first hopper to be fed into the packaging machine. Figure 7 illustrates the frame 62 in a second position with the second hopper 60, containing the basket type cartons, placed in an operative position.

The position of the hoppers 58, 60 is controlled by a control means detailed below.

As shown in Figures 6 and 7, when the first hopper 58 is in an operative position a fully enclosed carton is removed sequentially by a pick up device, preferably in the form of a rotary vacuum feeder 66. The vacuum feeder 66 comprises sets of suction cups 67, 69, for example three sets, each being connected to a drive shaft 70 by a drive rod 72. The drive shaft 70 is supported at its end by a suitable conventional bearing 71, 73, mounted to the side frame 84. Suitable driving mechanism such as a servo motor 75 is provided to rotate the drive shaft. The drive rods 72 are connected to a cam track by a cam rod and follower which provides a uniform path for the suction cups when the drive shaft is rotated.

The path of the cam track enables the suction cups to extend towards the hopper to pick up a carton in a flat collapsed condition and thereafter to rotate the suction cups and carton to the infeed end of the machine.

In order for the blank to be transferred from the inclined position to a vertical plane, it is necessary to offset the axis of rotation of the rotary feeder from the vertical plane, as illustrated in Figures 6 and 7.

A vacuum is applied to one set of suction cups 67, 69 to remove a carton from the hopper 58, 60, when they come into contact with the side wall 32 of the carton 30. The vacuum is maintained as the carton is rotated to a predetermined position. At the said predetermined position a vacuum break disconnects the supply to release the carton 30 from the feeder 66.

If it is desired to package a different carton type for example a basket type carton 10 held in the second hoppers, a number of adjustments are made to the machine. The second hopper 60 is moved into an operative position, as described above. As the position of the second hopper relative to the rotary feeder 66 is different to the first hopper 58, it is necessary to move the "pick up" point of the suction cups 67, 69 and to alter the "on" and "off" positions of the vacuum supply. These changes are carried out by moving the cam track and/or the cam controlling the supply of a vacuum to a second position. A servo motor 167, shown in figure 8 controlled by the control system moves these sub-assemblies between the two positions.

It is preferred to include a third position for the vacuum supply: this position being the "default setting" whereby the vacuum supply is disconnected throughout the rotation of the suction cups. The default position is adopted during carton changeover or if there is a fault in the machine.

Figure 8 illustrates the pick up device adapted for the withdrawal of the lower most collapsed carton from the hopper unit. As described above, the preferred pick up device is in the form of a vacuum feeder 66 including suction cups 67, 69 which are supported on cup holders 74 and 76 respectively. Cup holders 74 and 76 are preferably fixedly mounted respectively on an elongate support rod 78 which is slidably mounted respectively on a collar structure 80, which collar structure is rigidly secured to a main rotatable shaft 70. The cup holders 74, 76 are mounted onto cam rods 79 extending into the side frame 84 housing a cam track hereinafter described. As illustrated from Figure 8, three sets of carton pick up devices are provided in association with the main rotatable shaft 70. Only one set of such devices are described in detail because all three sets of pick up devices are of the same construction operating in an identical fashion.

Figure 9 serves to illustrate an exploded view of the rotary vacuum feeder. A fixed cam plate 82 is mounted on the inner surface of side frame 84 and is provided with an aperture 86 through which the drive shaft 70 extends. A cam track 88 is formed in the fixed cam plate 82 with cam followers (not shown) disposed within the cam track 88. The purpose of the cam track 88 is to facilitate the cam rods 79 to be extended away from the main shaft 70 and into contact with the carton thereby to remove one of the cartons from the hopper 58 and to rotate the carton in a uniform path to the paper feed chain 100, discussed below. As the carton is rotated from its hopper a back feeder is used to separate opposing side panels and to assist in the erection of the carton.

A plurality of vacuum breaks are provided in the feeder mechanism 66 which is used in conjunction with a vacuum supply to set the vacuum connection and cut off points.

Turning to the process of feeding a carton from the hopper to the paper feed chain, the main shaft rotates the pick up device 66 in the direction indicated by the arrow "Z" in Figures 10 and 11. As the pick up devices rotate, the suction cups

67, 69 are moved into contact with a side wall 32 of the carton 30. A vacuum is then applied to the set of suction cups when the cups come into contact with the side wall 32 of the carton 30. Thus, the carton is withdrawn and then transferred to the paper feed chain 100. The vacuum is maintained during this transfer state so that the suction cups hold the carton wall. When the carton is deposited at the paper feed chain, a vacuum break disconnects the vacuum supply from the suction cups to release the carton. The speed of operation of the apparatus is thus improved as well as its efficiency and durability.

As can be seen from Figure 12, the carton is moved from a collapsed position to a fully set up condition at the paperfeed chain 100 . Of course, the final set up operation is due in part to engagement with a back feeder (or carton opening means) 90.

Turning to the construction of the back feeder 90, shown in Figures 10 to 13, there comprises suitable engagement means for engaging one or more walls of the carton. In the present embodiment, the engagement means comprises a suction cup 92 supported on a cup holder 94 which is mounted onto a slide member 96. Suitable means is provided to move the engagement means in "X" and "Y" directions. For example, the slide member 96 is in turn mounted onto a transverse carriage 98 and is capable of being moved in a direction designated by the letter X. The transverse carriage 98 is preferably connected to a guide rail 99 which is fixed to a support frame (not shown): the transverse carriage being adapted to move the suction cup and slide member in a direction designated by the letter Y. Thus, the suction cup 92, is capable of moving towards or away from the rotary vacuum feeder 66 and in perpendicular direction to the orbital path Z of a carton. If desired, limit stops may be included at the ends of the slide member and/or guide rail.

It is envisaged that alternative components or configurations can be used to provide an assembly which can move in X-Y directions.

The slide member 96 is moved by suitable drive means for example a first linear servo motor (not shown) which is controlled by a suitable control system and the transverse carriage 98 is moved by second drive means for example a second linear servo motor (not shown) which is also controlled by the control system. Therefore, the position of the back feeder suction cup 92 can be moved to any desired position. In some embodiments, the control system is programmed to pre-set suitable X-Y co-ordinates and to define the path of the suction cup. More details of the control system are discussed below.

In use, the back feeder 90, separates one or more of the walls 34 of the carton from the opposing wall 32 held by the rotary feeder 66. In this embodiment, the opposing walls used are the side walls 32, 34. As the rotary feeder 66 transfers the carton, the suction cup 92 of the back feeder 90, is moved forward into contact with a side wall 34 of the collapsed carton 18, shown in Figure 10. Preferably, the point of contact is in a central portion of the wall being separated. Vacuum is applied to the suction cup 92 to hold the side wall 34. As the rotary feeder 66 continues to rotate the carton forward, the back feeder suction cup 92 moves away from the rotary feeder 66 to separate the two side walls, 32, 34 shown in Figure 11.

In this embodiment, the leading pair of suction cups 67, 69 of the rotary feeder release the leading end panel 46. Thus, the carton is folded into a part erected condition with the side and end walls being placed in substantially trapezoidal relationship. The back feeder vacuum supply is then disconnected and the carton is released from the back feeder shown in Figure 13.

Whilst it is preferred to use a suction cup to hold one of the walls, some embodiments may adopt alternative components, for example, mechanical connection means.

As discussed above, the preferred "pick up" position of the back feeder suction cup 92, is at an approximately central point of the carton side panel. This position will vary according to the type of carton, and in particular the dimensional variations of the side and end walls for each carton type and for different carton sizes. Likewise, the path of the suction cup separate the two walls will also vary according to the particular carton type being erected. It is envisaged that the suction cup can follow an oscillatory path similar to that disclosed in WO 92/15450. Alternatively, a rotary path could be used for some cartons. An advantage of the back feeder is the flexibility offered by the system. In particular, the back feeder is able to move the suction cup 92 to any position to adopt any number of paths within the end stop limits of the slide member 96 and the transverse carriage 98. An example of the paths followed together with velocity and acceleration components of the "X" and "Y" driving means is illustrated in Figures 14 and 15.

By pre-programming the control system, the position and paths of the suction cup 92 can be pre-set, thus reducing the amount of down time when interchanging carton types or styles. According to this invention, the speed of operation of the apparatus is improved as well as its efficiency and durability.

The carton 30 continues on its orbital path until it comes into contact with the paper feed chain 100. In particular, the leading edge 102 of the carton 30 comes into abutment with the leading lug 104 of the paper feed chain 100. The leading lug 104 guides the leading edge 102 away from the suction cups 67, 69 of the rotary feeder 66, thereby placing the front end panel 46 and side panel 34 in a substantially perpendicular relationship. At the same time, the rear lug 106 moves into contact with the rear end panel to assist in completing the set up. Thereafter, the suction cups 67, 69 of the rotary feeder 66 release the carton 30 and continue to move in direction "Z" and the carton 30 is moved downstream to the loading station by the paper feed chain 100.

Turning to the construction of the paper feed chain 100 as illustrated in Figures 4 and 10, there comprises upper and lower side lug chains 108 and 110. Each set is of similar construction and includes endless chains having a plurality of leading and trailing lugs 104 and 106. The upper chain 108 includes leading lugs 104 and the lower chain 110 comprises rear lugs 106. Each chain set is moved forward by drive means, for example one or more servo motors controlled by the control system.

In order to alter the machine set up from one carton type to another, it is necessary to alter the distance D between leading and trailing lugs. Therefore, during changeover, the servo motor controlling the lower chain moves the trailing lugs 106 relative to the leading lug 104 to increase or decrease the distance between the lugs. For example, the side walls of basket type carton are shorter than the fully enclosed carton so that if the carton changeover is from a fully enclosed to a basket type carton, then the distance D is reduced. Likewise, the opposite changeover means the distance D is increased. In this embodiment, the distance between leading and trailing lugs is increased or reduced by 10 cm.

The relative movement of the trailing lug 106 will alter the position at which the trailing lug 106 comes into contact with the rear end panel of the carton described above. It is necessary for the rear lug 106 to come into contact with the end panel whilst it is being rotated. If the rear lug 106 is moved forward, the point of contact is also moved forward. To restore the point of contact to the correct position, it is necessary to move the paper feed chain 100 backwards by the corresponding distance (i.e. 10 cm). It will be appreciated by those skilled in the art that if the rear lug 106 is moved away from the leading lug to increase distance D, then the paper feed chain will have to be moved forward by a corresponding distance. A pneumatic cylinder (not shown) is used to move the paper feed chain 100.

The erected carton is moved forward by the paper feed chain 100 and is held in place by a horizontal plate (not shown) and onto the carton lowering module 111. The base panels 46 of the carton are then outwardly folded by guides 114 positioned either side of the carton.

After the cartons have been set up, they are transferred to the loading station 120. Thus, the cartons leave engagement with the paper feed chain 100 and engagement is gradually transferred as the cartons move downstream to a carton lowering module 11, shown in Figures 3 and 4.

The carton lowering module comprises a conveyor, for example, a pair of side lug chain sets 112 mounted on tables 113 respectively which are downwardly inclined towards the point of loading 114. Each side lug chain set 112 is of similar construction includes an endless chain 115 powered by a motor, such as a servo motor. Suitable means connected to the side lug chain sets are provided to periodically engage cartons supplied from the paper feed chain. In this embodiment, the carton engaging means comprises a plurality of guide pin lugs 116 mounted on the endless chain which are operable to engage the opposed base panels 24, 26 of a carton and to retain the base panels 24, 26, side panels 12, 14 and end panels 16, 18 in a set up condition as it moves downstream.

Each lug 116 is preferably substantially wedge shaped and comprises a support face 117 arranged at an acute angle with respect to a notional vertical plane. A plurality of pins, for example four pins 118 are mounted at spaced intervals along the support face 117. Each pin 116 is positioned on the support face 117 so that during use they are received in corresponding apertures of the base panel being supported thereby to engage the carton. In this embodiment, only the leading three of the four pins are required for the basket type carton. Of course, for the larger cartons such as the fully enclosed cartons, all of the pins are used. Conversely, a smaller carton may only require to be engaged by two of the pins.

The endless chain is moved by a motor, for example a servo motor. As each lug 64 moves along the path of a cam track (not shown), the cartons 10 are maintained in a horizontal plane by the lugs 116 as they are lowered by the endless chain set 113 towards the loading station 120.

It is envisaged that the lowering module can be used to load cartons with different configurations of articles, for example two rows or three rows. Accordingly, either or both chain sets and tables are moveable towards or away from each other, by means of a pneumatic cylinder (not shown). Further, the carton lowering module can be raised or lowered by hydraulically powered columns that support the tables. The pneumatic cylinder and/or hydraulically powered columns may be controlled by suitable control means.

Articles such as bottles 122 are fed into the machine by an end feed conveyor 124 and the line pressure of the bottles is controlled by an infeed star wheel 126, as is well known (Figure 16). The articles are separated into groups of the correct number per carton 30 by means of a series of article grippers 128 which also control the flow of the articles so that they can be introduced to the carton at the same rate as the carton flow.

Turning to the construction of article gripper assembly 128 positioned either side of the article conveyor, there is provided pairs of four blocks or spacer elements 131 mounted onto separate endless chains. Each block comprises four semi-circular recesses 133 positioned one to the next and capable of receiving part of a bottle or can. The endless chain is mounted on a table. One or both of the gripper assemblies can be moved toward or away from the article conveyor according to whether two or three rows of articles are required. In this embodiment, gripper assembly is moved towards the second gripper assembly when it is desired to package two rows of articles. Thus, each gripper assembly is adapted to grip part of those articles forming each outer row, as shown in Figure 16. The distance between infeed star wheels is also narrowed to ensure that the

article flow is restricted to two rows, when required or moved to allow three rows when required. In those cartons which required six articles arranged in two rows of three articles each, the leading rebate in each gripper block remains empty.

For those cartons requiring three rows of articles, the central row of articles is moved forward by means of the configuration adopted in Figure 15. Thus, the correct number of articles is selected.

The articles gradually leave contact with the gripper assembly and are transferred to the loading station by means of article conveyor.

At loading station 120 illustrated in Figure 4 the cartons are introduced to the group of articles from above as the carton and article group are moved forward in unison. The carton is lowered onto the articles due to the downward incline of the endless chain sets on the carton lowering module, as described above. As illustrated in Figure 3, lateral movement of the carton in the loading station is controlled by a pair of guides positioned above each chain set and adapted to receive the free edges of each base panel. Vertical movement of the carton is minimised by a pressure belt positioned above the endless chain sets and adapted to apply downward pressure to the handle structure or as the case may be the top panel. It is envisaged that in some embodiments, the pressure belt could be replaced by fixed guides or, where appropriate, vertically mounted endless chain and lug sets in accordance with common practice.

Once the cartons have been loaded with articles, they are transferred by means of the article conveyor and/or pressure belt to a further set of endless chains with side lugs 210 which are used to transfer the carton to the outfeed end of the machine. During this stage, the base panels are folded around to the underside of the carton by suitable folding means for example fixed guides (not shown) and are interconnected by a locking mechanism known in the art. A second pressure belt 212 is provided to prevent unwanted upward movement of the carrier.

Turning to the construction of wraparound type cartons, as illustrated in Figures 3a and 3b, the machine is first adjusted to receive cartons of this type. Thus, the first and second pressure belts 206, 212 are also mounted on units shown in Figure 17 which are adjustable in a vertical plane by computer controlled servo motors.

In order to modify the machine to receive wraparound cartons of the type illustrated in Figures 3a and b, the article grouping mechanism is adjusted as described above, to supply the required number of article rows. The hopper 200 illustrated in Figure 17 holds a multiplicity of carton blanks 31 which are held ready for processing. The blanks are then removed sequentially by a rotary vacuum feeder 202. In this embodiment, the vacuum feeder 202 is mounted horizontally and is similar in construction to the feeder outlined above. It is envisaged that suitable feeders known in the art may be used. In this embodiment, the rotary feeder is provided with a cam track which enables the carton being transferred to be placed directly on to the group of articles. Suitable control means is used to control the transfer of cartons and articles so that their movement is coordinated. In other embodiments, the blank is removed from the hopper 200 and is fed one at a time to paper feed chain sets so that the base panels and side panels are supported.

The articles are introduced to the loading station 204 by the article conveyor in the same way as described above.

At the loading station 204, upper portions of the articles are inserted through apertures 43, 45 by lowering the cartons. In this embodiment, this process is achieved by the first pressure belt 206 which is positioned in a central region to lower the top panel and enable the neck portions of the articles to pass through the apertures. In this embodiment, the first pressure belt is mounted onto a hydraulic platform 208, which is capable of being raised or lowered according to the carton type. Suitable control means is used to control the level of the platform.

As the carton is moved downstream by side lug chain sets 210, the side panels 35 are folded into a substantially perpendicular relationship with top panel 39 by fixed guides (not shown) and the part erected carton is transferred to the second set of endless chains which transfer the carton to the outfeed end of the machine. In this embodiment, the second pressure belt 212, used to minimise movement of the top panel/handle structure, can be raised or lowered as appropriate to the carton. Likewise, the set of endless chains 210 are moved apart or brought closer together by means of horizontal adjustment which are controlled and powered by servo motors (not shown). The base is constructed by known means 214 and, where appropriate, article retaining panels are formed by known means 216. Thus, the carton is secured to complete the packaging operation.

Figure 18 is a block circuit diagram illustrates the electrical and electronic control of the packing machine 50.

Figure 18 illustrates a control means 130 having a central processor 132, a manual input means 134 through which specific instructions can be programmed, and a display 136 which indicates useful information to the machine operator. The central processor 132 and the display 136 can display operational information, such as, the speed of operation of the machine and its compliance with particular safety requirements, in the normal manner. In addition, the central processor 132 and display 136 can also indicate information specific to the present machine, such as the feeder 58, 60 which is being used, the position of the guide lugs 104 and 106 and support means 112 and the position of the feeder 66 and the back feeder 90. All of this information is provided through sensors shown generally at 138.

As discussed above, the control means 130 also controls the positions of the moveable components as well as the speed of movement of variable speed components. For example, the central processor 132 controls the motors 140 which power the feed means (drive belt, star wheel and blocks) which move articles 122 to be packed into (the infeed end of) the machine 50.

The processor 132 also controls the position of the feeder 66 through actuation of a pneumatic cylinder 142 as well as the position of the back feeder 90 through programmed and accurate control of X and Y servo motors 144. In addition the central processor 132 also controls the paper feed chain 100 through control either or both of the servo motors 146 which control the endless chains from which the guide lugs 104 and 106 are depended, as well as the pneumatic cylinder 148 which controls the position of the support structure 112.

Suitable control means can be included to position the support tables of the carton loading module at the desired location for a particular carton type or size by controlling the pneumatic cylinder and/or the hydraulically powered columns 96, 98. The control means may also control the motors driving each of the endless chains to control and adjust the speed and to synchronise carton throughput according to the carton type and/or size.

Additionally, the control means may control the wraparound carton feeding and loading apparatus to place the apparatus in operative or inoperative conditions, as described above.

As will be discussed below the positions and speed of these devices can be input manually or a specific pre-written programme can be loaded into the central processor for control of the packaging machine. Also, for the controlled change over of the machine from one carton type or size to another can be the result of a pre-written program or a manual input signal, as discussed below.

Regarding Figures 19 the change over process is started (box 150) either due to a manual input request (box 152) or through the machine coming to the end of a pre-programmed run (box 154).

The first stage in the system is to cause the feeder 66 to stop picking cartons from one of the hoppers 58, 60 (box 156). At this time the back feeder or carton

opening means 90 is also stopped (box 158). The paper feed chain 100 is continued to operate until empty of cartons. In the present invention this requires the four cartons placed between the first and second predetermined locations to be removed from the paper feed chain 100.

However, unlike prior art embodiments this removal is not manual but the paper feed chain 100 is continued to operate until these cartons are removed for filling at the carton filling station 120, in the normal manner (box 160). At this point the paper feed chain 100 is stopped (box 162). Sensors, as discussed above, can provide the central processor 132 with information on a number of articles to be packed so that the article feed means can be stopped at such a point that all of the necessary articles have been forwarded for the packing of the four above mentioned cartons (box 164).

At this point the guide lugs 104 and 106 on the paper feed chain are repositioned, with respect to each other, as discussed above (box 166), and the support means is repositioned with respect to the first predetermined position, also as discussed above (box 168).

The feeder 66 is then repositioned for use with the other hopper 58, 60, as discussed above (box 170).

Also, the program under which the locus of the cup 92 on the back feeder or carton opening apparatus 90 is operating is controlled so that this device will operate with the carton feeder 66 so as to open cartons from the hopper now being used (box 172).

Finally, the article feed means is controlled so that the appropriate number of articles is provided to the packing station 120 at the appropriate time, as discussed above, (box 174).

After each of these steps have been taken the packaging machine 50 can be restarted and cartons removed from the newly used hopper for filling in the usual fashion (box 176). It should be noted that the restart of the carton picking process and the article supply process are controlled such that no articles go unpacked and no cartons are supplied to the packing station without corresponding articles.

Modifications may be made without departing from the scope of the present invention. In particular, alternate sensors and alternate means of positioning each of the moveable articles may be utilised without departing from the scope of the invention as claimed in the accompanying claims.

In addition, while the preferred embodiment described herein is for loading bottles into cartons, it will be recognised that the invention is not limited to cartons for bottles. The invention may be used with machines for packaging cans, paperboard "bricks" and other containers into cartons. Further, the present invention is able to process cartons comprising numerous configurations of groups of articles covering a range of carton size and shape, for example four, six; eight and twelve bottles without undue time being spent in adjusting the mechanism.

Claims:

1. A packaging machine for packaging articles into cartons selected from, at least, a first carton or a second carton, said first and second cartons being of a different type or size, said cartons being stored in at least one hopper, and picked for packing by a carton engaging means arranged to remove cartons from said at least one hopper and transport them sequentially to a first predetermined position, from where the cartons are transferred to a paper feed chain which transports the cartons to a second predetermined position, from where the cartons are combined with said articles,

the paper feed chain comprising a support means carrying a first endless chain from which is depended a first set of guide lugs and a second endless chain from which is depended a second set of guide lugs, said guide lugs being interleaved to produce carton receiving zones, the length of which can be altered, for different carton sizes or types, by altering the relative positions of the first and second set of guide lugs, and the support means being movable such that when the relative positions of the lugs is changed, this change can be compensated for such that the position of the first set of lugs with respect to said first predetermined position is unaltered.

2. A packaging machine as claimed in Claim 1, wherein the relative position of the first and second sets of guide lugs is arranged by control of the motor which power one of the first and second endless chains.

3. A packaging machine as claimed in Claim 1 or Claim 2, wherein the position of said support means is arranged by the control of a pneumatic cylinder which positions said structure.

4. A packaging machine as claimed in an preceding claim, comprising a control means which controls the operation of each of the components of the

machine during operation and change over between cartons of different type or size.

5. A packaging machine as claimed in any preceding claim, comprising a first hopper for storing said first cartons, and a second hopper for storing said second cartons, and transfer means to transfer the cartons from either hopper to said first predetermined position, said carton engaging means being operable in a first position for engaging cartons from the first hopper and a second position for engaging cartons from the second hopper.

6. A packaging machine as claimed in Claim 5, comprising means to place one of said hoppers in an operative position and control means to select the position of carton engagement means corresponding to the operative hopper selected.

7. A packaging machine as claimed in Claim 5 or Claim 6, wherein said carton pick up and transfer means is rotatable about a fixed axis in an orbital path.

8. A packaging machine as claimed in Claim 8, wherein the first and second pick up positions are located at different points on said orbital path.

9. A packaging machine as claimed in any of Claims 6 to 8, comprising means to place one of said hoppers in an operative position in the form of a frame mounted to a second fixed axis and wherein said first and second hoppers are mounted to the frame each hopper being oppositely disposed about the second fixed axis.

10. A packaging machine as claimed in any of Claims 6 to 9, wherein said operative hopper is adjacent the orbital path of said carton pick up and transfer means.

11. A packaging machine as claimed in any preceding claim comprising an apparatus for sequentially manipulating out of said at least one hopper collapsed cartons having oppositely disposed face contacting panels and for initiating set up thereof into an open ended condition, said apparatus being operable with said carton engaging means which sequentially engaging one of said face contacting panels and for withdrawing from the hopper a collapsed carton which includes said one of said face contacting panels and transferring orbitally about a rotatable axis from said hopper to said first predetermined position, wherein said apparatus includes panel engagement means disposed outside the path of orbit for engaging the other of said face contacting panels so as to pull said other face contacting panel in a direction away from the carton pick up means thereby to initiate opening of the carton.

12. A packaging machine as claimed in Claim 11, wherein the panel engaging means is moved in a first plane by a linear servo motor.

13. A packaging machine as claimed in Claim 11 or Claim 12, wherein said panel engaging means is mounted to a slide member in a substantially perpendicular relationship with a guide rail and wherein said slide member is moveable relative said guide rail whereby said panel engaging means is moveable in two planes.

14. A packaging machine as claimed in Claim 13, wherein said panel engaging means is moved in a second plane by a further linear servo motor.

15. A packaging machine as claimed in any of Claims 11 to 14, wherein control means are arranged to control the movement of the panel engaging means.

16. A packaging machine as claimed in any of Claims 13 to 15, wherein said panel engaging means comprises a suction cup and cup holder mounted onto said slide member, said suction cup being connected to a vacuum supply during said carton opening.

17. A packaging machine as claimed in any of Claims 11 to 16, wherein said face contacting panels comprise opposition side walls of the carton.

18. A packaging machine as claimed in any preceding claim, having an article feed means arranged to progress articles at a predetermined rate along a feed path for combination with cartons at a measured rate.

19. A packaging machine as claimed in Claim 18, wherein the article feed means includes a pair of star wheels which collect articles from a first feed belt and move them to a second feed belt at said predetermined rate.

20. A packaging machine as claimed in Claim 19, wherein gripper blocks are arranged on opposite sides of said second feed belt to collect a predetermined number of articles and arrange them as an individual unit for packaging into a carton.

21. A method of packaging articles into cartons comprising the steps of:

a) selecting from, at least, a first carton or a second carton, said first and second cartons being of a different type or size, said cartons being stored in at least one hopper;

b) picking cartons for packing using a carton engaging means arranged to remove cartons from said at least one hopper and transport them sequentially to a first predetermined position;

c) transferring said cartons to a paper feed chain which transports the cartons to a second predetermined position from where the cartons are combined with said articles, the paper feed chain comprises a support means carrying a first endless chain from which is depended a first set of guide lugs and a second endless chain from which is depended a second set of guide lugs, said guide lugs being interposed to produce carton receiving zones, the length of which can be altered, for different carton sizes or types;

d) altering said length by altering the relative positions of the first and second set of guide lugs; and

e) moving the support means when the relative positions of the lugs is changed, so as to compensate for said change, such that the position of the first set of lugs with respect to said first predetermined position is unaltered.

22. A method claimed in Claim 21, wherein the relative position of the first and second sets of guide lugs is arranged by control of one of the motors which power the first and second endless chains.

23. A method as claimed in Claim 21 or Claim 22, wherein the position of said support means is arranged by the control of a pneumatic piston which positions said structure.

24. A method as claimed in Claims 21 to 23 utilising a control means which controls the operation of each of the components of the machine during operation and change over between cartons of different type or size.

25. A method as claimed in any of Claims 21 to 24 wherein the carton engaging means is positioned for engagement with cartons from a first hopper in a first position and is positioned for engagement with cartons from a second hopper, in a second position, the carton engagement means being movable between said first and second positions.

26. A method as claimed in Claim 25, comprising placing one of said hoppers in an operative position and selecting the position of the carton engagement means corresponding to the operative hopper selected.

27. A method as claimed in Claim 25 or Claim 26, wherein said carton pick up and transfer means is rotatable about a fixed axis in an orbital path.

28. A method as claimed in Claim 25, wherein the first and second pick up positions are located at different points on said orbital path.

29. A method as claimed in any of Claims 26 to 28 comprising mounting said first and second hoppers on a frame such that each hopper is oppositely disposed about a second fixed axis.

30. A method as claimed in any of Claims 26 to 29, wherein said operative hopper is adjacent the orbital path of said carton pick up and transfer means when in use.

31. A method as claimed in any of Claims 21 to 30 comprising sequentially manipulating out of said at least one hopper collapsed cartons having oppositely disposed face contacting panels and initiating set up thereof into an open ended condition, by sequentially engaging one of said face contacting panels and withdrawing from the hopper a collapsed carton which includes said one of said face contacting panels and transferring orbitally about a rotatable axis from said hopper to said first predetermined position, wherein panel engagement means is disposed outside the path of orbit for engaging the other of said face contacting panels so as to pull said other face contacting panel in a direction away from the carton pick up means thereby initiating opening of the carton.

32. A method as claimed in Claim 31, comprising moving the engaging means in the first plane by a linear servo motor.

33. A method as claimed in Claim 31 or Claim 32, comprising mounting said panel engaging means to a slide member in a substantially perpendicular relationship with said guide rail and moving said slide member relative to said guide rail whereby said panel, engaging means is moveable in two planes.

34. A method as claimed in Claim 33, comprising moving said panel engaging means in a second plane by a linear servo motor.

35. A method as claimed in any of Claims 31 to 34, wherein control means are arranged to control the movement of the panel engaging means.

36. A method as claimed in any of Claims 31 to 35, wherein said panel engaging means comprises a suction cup and cup holder mounted onto said slide member, and connects said suction cup to a vacuum supply during said carton opening.

37. A method as claimed in any of Claims 31 to 36, wherein said face contacting panels comprise opposition side walls of the carton.

38. A method as claimed in Claims 31 to 37, comprising arranging article feed means to progress articles at a predetermined rate along a feed path for combination with cartons at a measured rate.

39. A method as claimed in Claim 38, comprising using a pair of star wheels to collect articles from a first feed belt and move them to a second feed belt at a predetermined rate.

40. A method as claimed in Claim 39, comprising arranging gripper blocks on opposite sides of said second feed belt to collect a predetermined number of articles and arrange them as an individual unit for packaging into a carton.

41. A control means for a packaging machine as claimed in any of Claims 1 to 20, the control means comprising a central processor , a manual input means, and separate means controlled by said central processor for individually positioning the first and second sets of guide lugs and the support means carrying said guide lugs on the paper feed chain.

42. A control means as claimed in Claim 41, wherein the means for positioning the support means is a pneumatic cylinder.

43. A control means as claimed in Claim 41 or Claim 42, for use with a packaging machine having two hoppers accessed by a single carton engaging means, wherein the control means comprises a means of positioning the carton engaging means in a first position for engaging cartons in said first hopper and a second position for engaging cartons in said second hopper.

44. A control means as claimed in Claim 43, wherein the means for positioning the carton engaging means is operable to position the engaging means in a third position, from which the carton engaging means cannot engage cartons in either hopper.

45. A control means as claimed in Claim 43 or Claim 44, wherein said means for positioning the carton engaging means is a pneumatic cylinder.

46. A control means as claimed in any of Claims 43 to 45, for use with a packaging machine having an opening means for opening cartons picked from each hopper, wherein the locus of motion of pick means on said opening means can be altered so that the opening means can open cartons picked from either hopper.

47. A control means as claimed in Claim 46, wherein the control means comprise X and Y oriented servo motors.

48. A control means as claimed in any of Claims 41 to 47, for use with a packaging machine having an article feed means in the form of a star wheel, the control means controlling the speed of rotation of the star wheel.

49. A control means as claimed in Claim 48, wherein the control means controls a motor which rotates the star wheel.

50. A control system for controlling the operation of a packaging machine as claimed in any of Claims 1 to 20, in order to change from first cartons in a first hopper to second cartons in a second hopper, comprising the steps of:

a) stopping the carton engaging means from picking any cartons;

b) continuing the paper feed chain until it is empty of cartons;

c) stopping the paper feed chain;

d) stopping the supply of articles;

e) repositioning the carton engaging means and the hoppers to enable picking from the alternative hopper;

f) altering the relative position of the first and second sets of guide lugs in said paper feed chain;

g) altering the position of the support means with respect to said first predetermined position; and

h) re-starting the carton picking and transportation process and the supply of articles.

51. A control system as claimed in Claim 50, wherein the instruction to changeover is read from a pre-entered control program.

52. A control means as claimed in Claim 50, wherein the instruction to changeover is manually entered into a control means.

53. A control system as claimed in any of Claims 50 to 52, wherein the packaging machine has a means for opening cartons, which is also stopped during the changeover process.

54. A control system as claimed in Claim 53, wherein the locus of movement of a pick means in said carton opening means is altered prior to restarting to enable the means to open cartons from said alternative hopper.

55. A control system as claimed in any of Claims 50 to 54, wherein the pick-up point and locus of the pick means in the carton engaging means is altered during the changeover to enable picking of cartons from the alternative hopper.

56. A control system as claimed in any of Claims 50 to 55, wherein the speed of supply of articles is alterable as required depending on the size or type of cartons in each of said hoppers.

57. A control system as claimed in any of Claims 50 to 56, wherein the relative positions and state of motion of each of the movable components is sensed using individual sensors and transmitted to the control means.

FIG. 1a

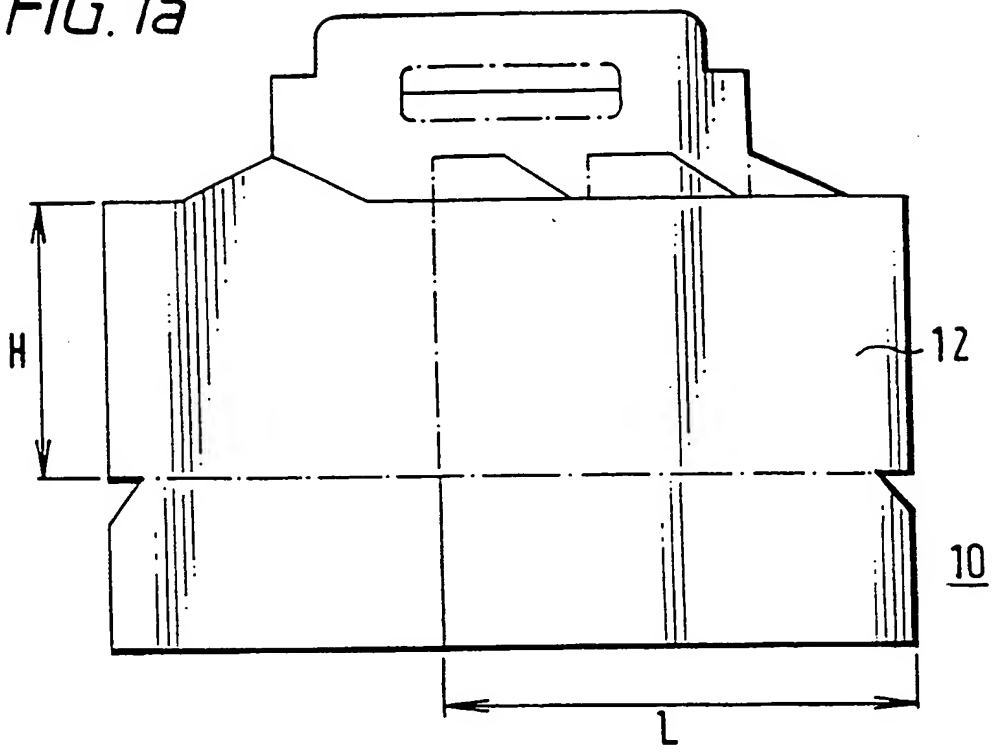
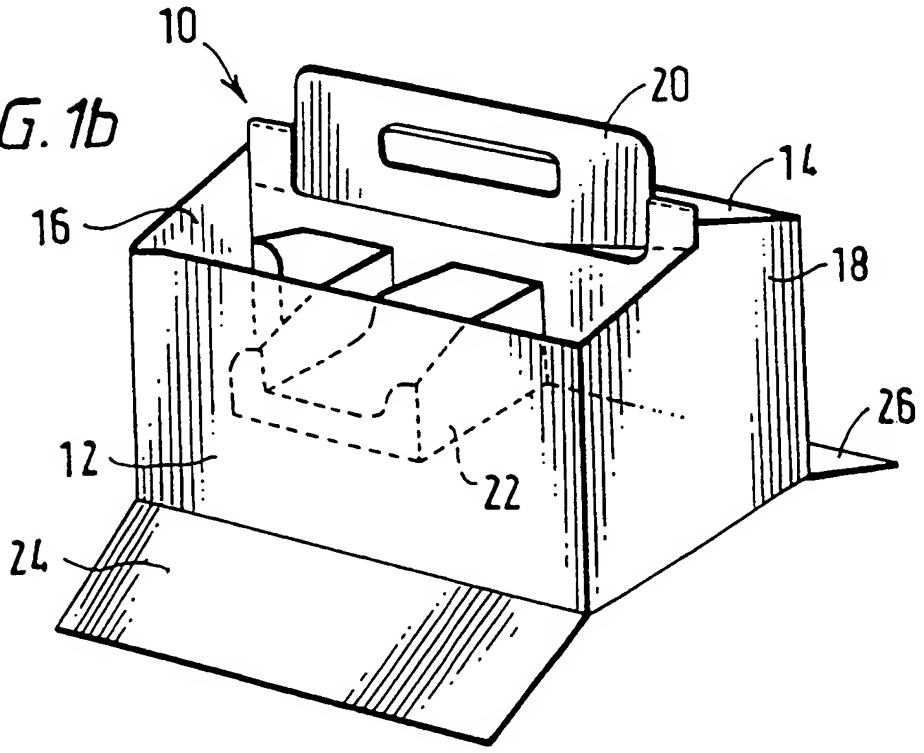


FIG. 1b



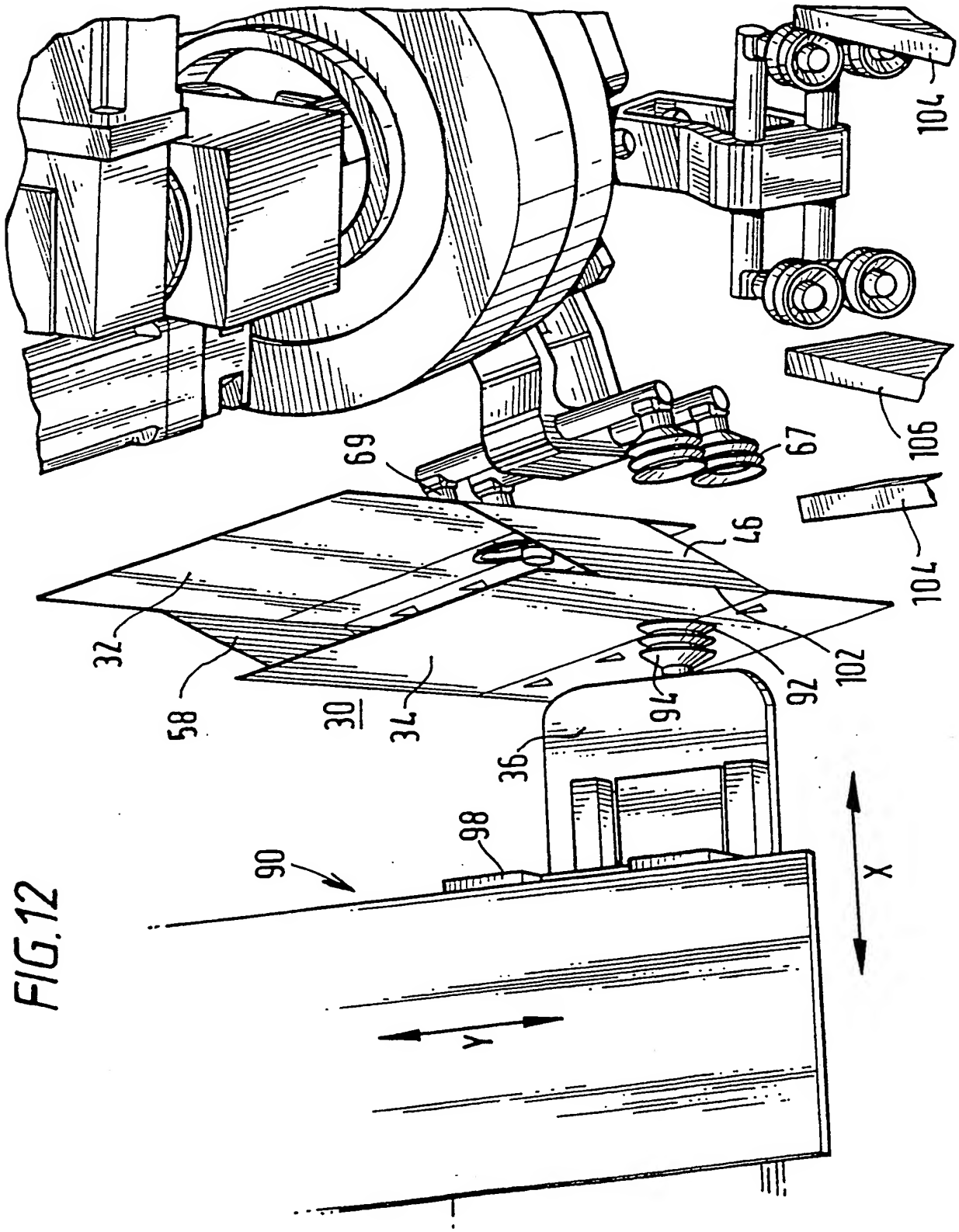


FIG.12

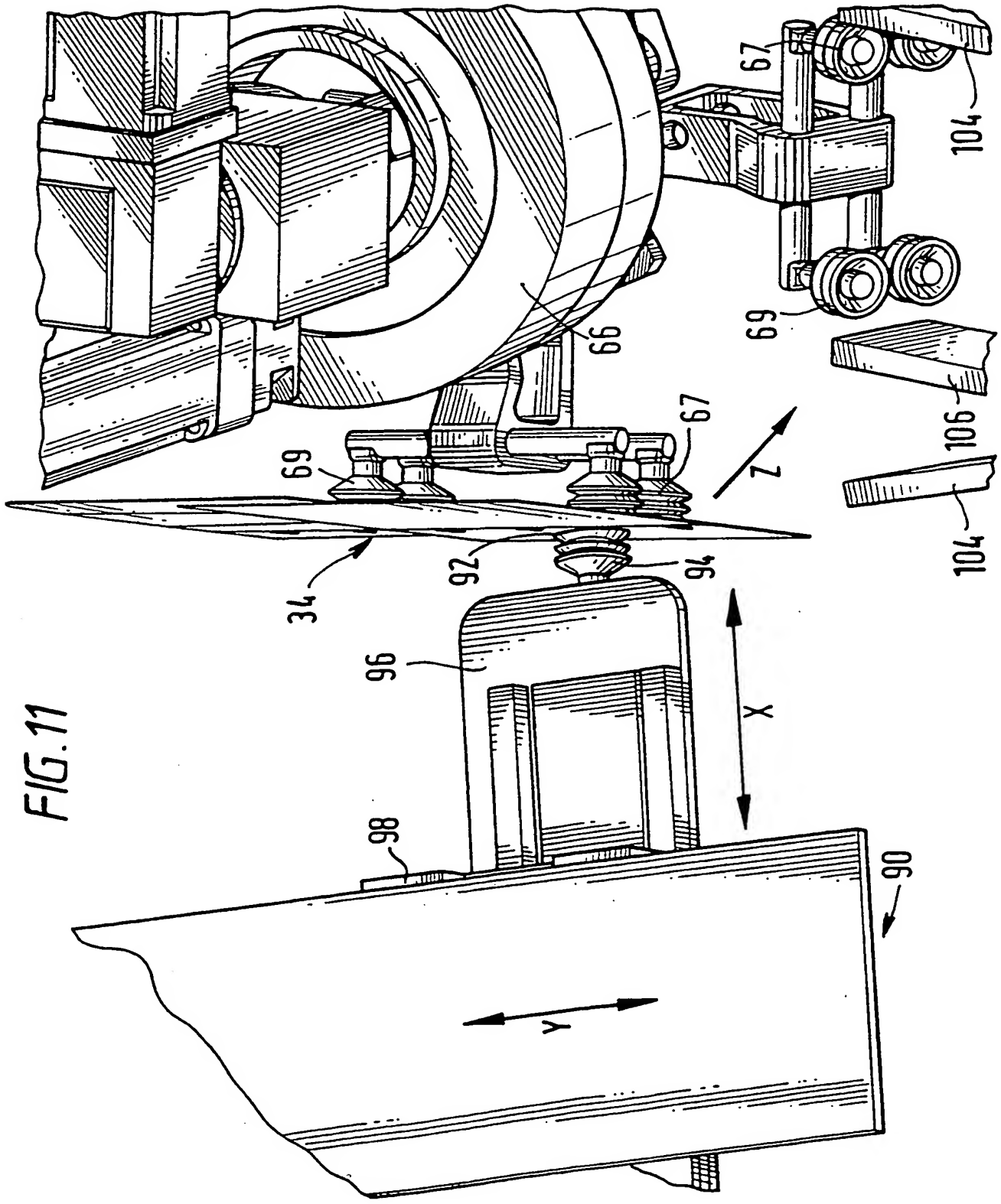


FIG. 11

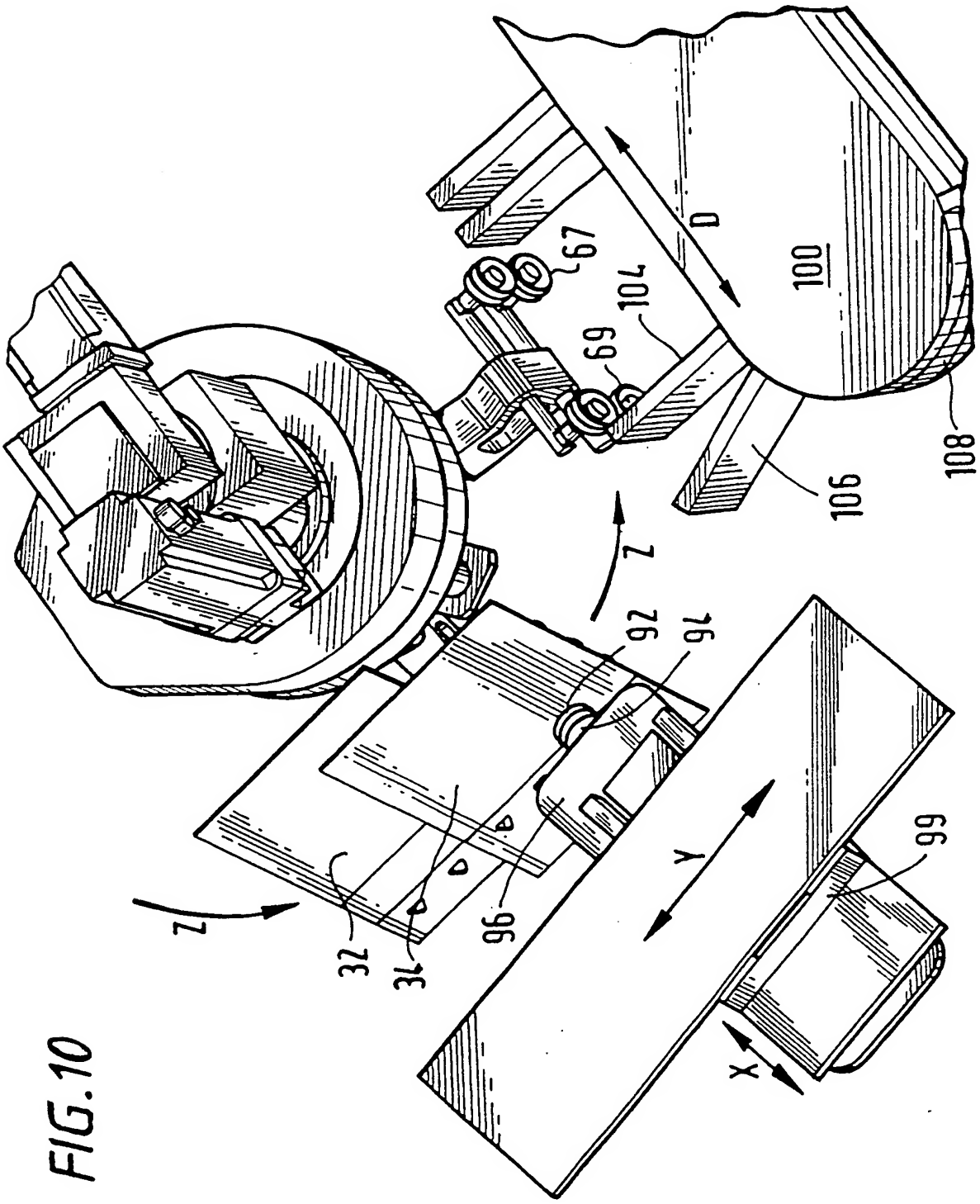
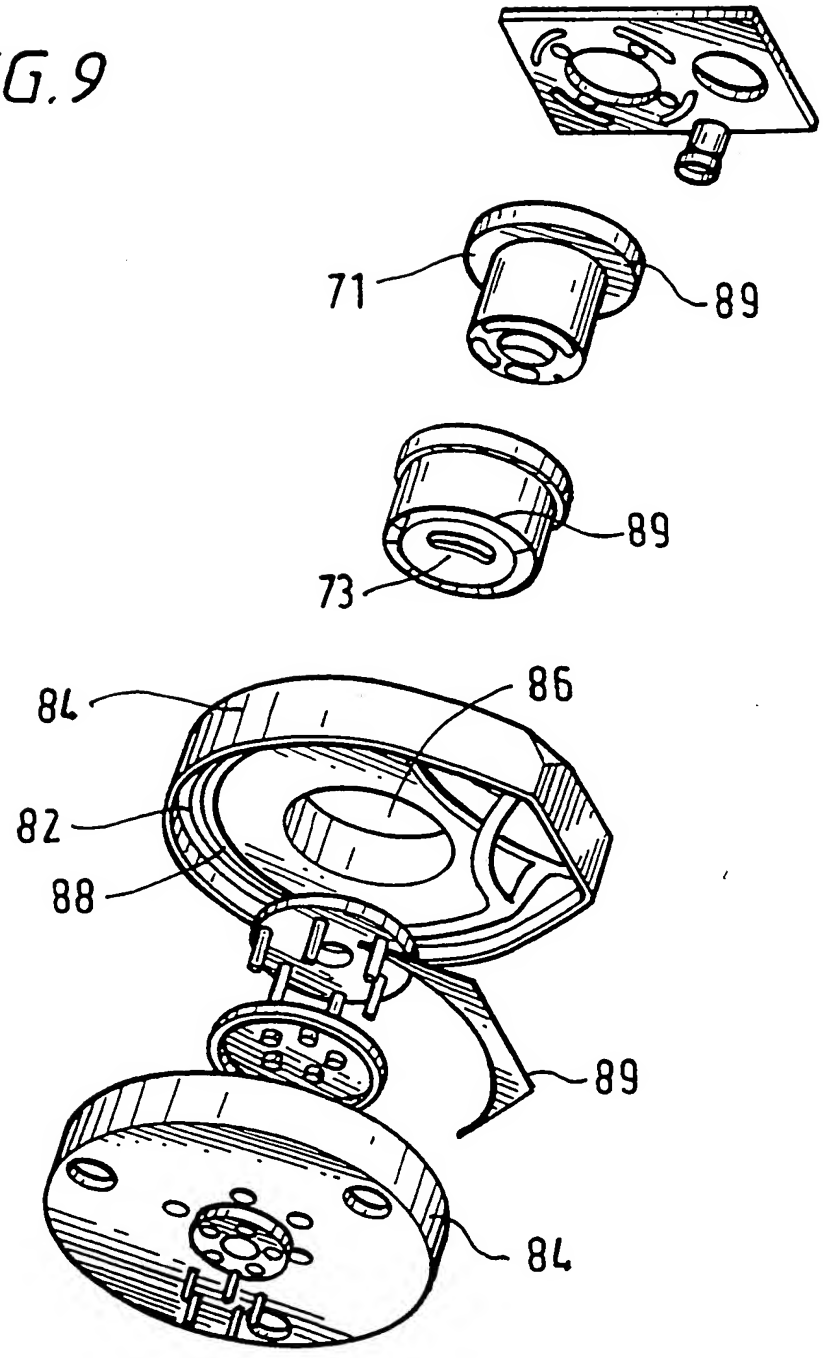


FIG. 10

FIG. 9



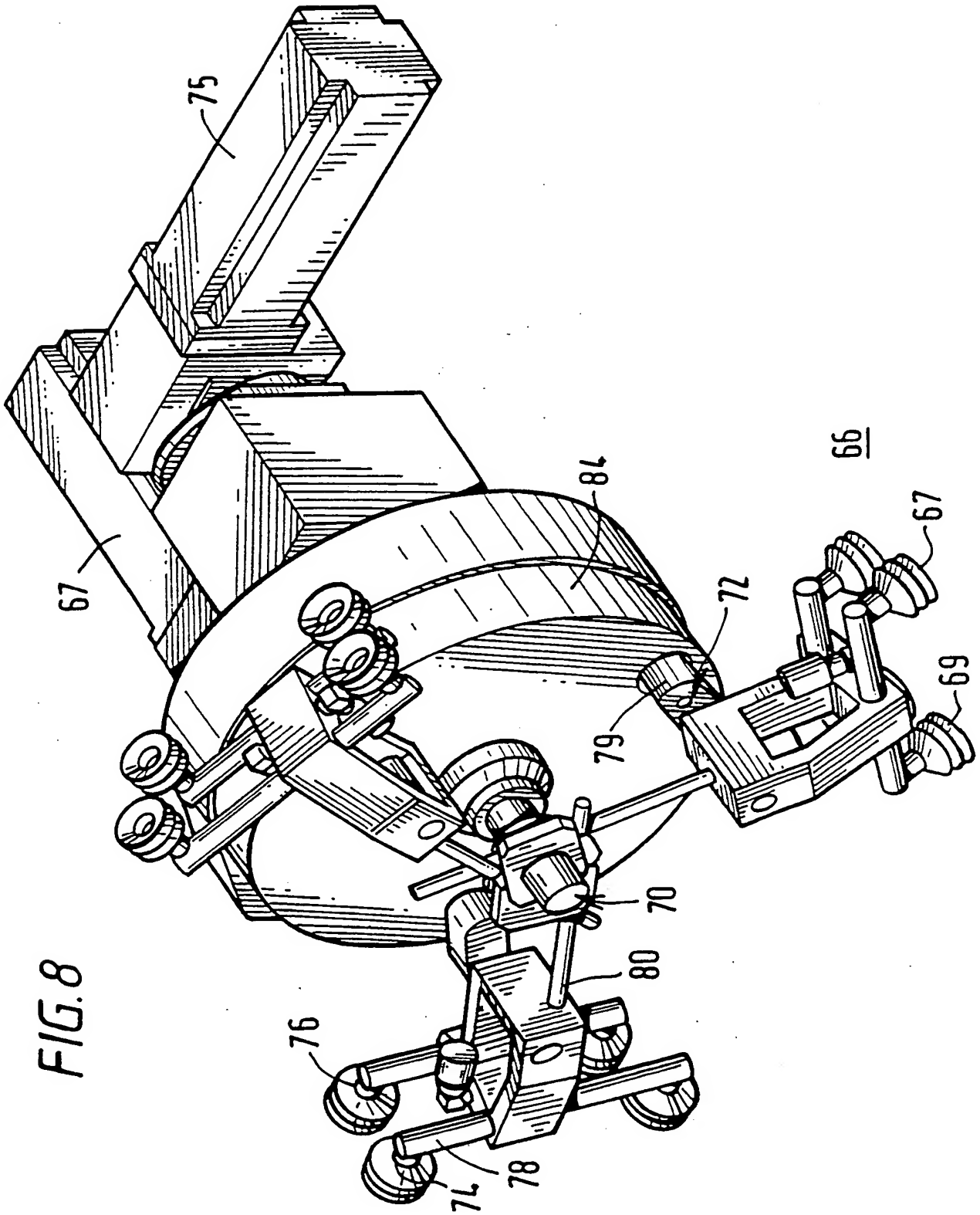


FIG.8

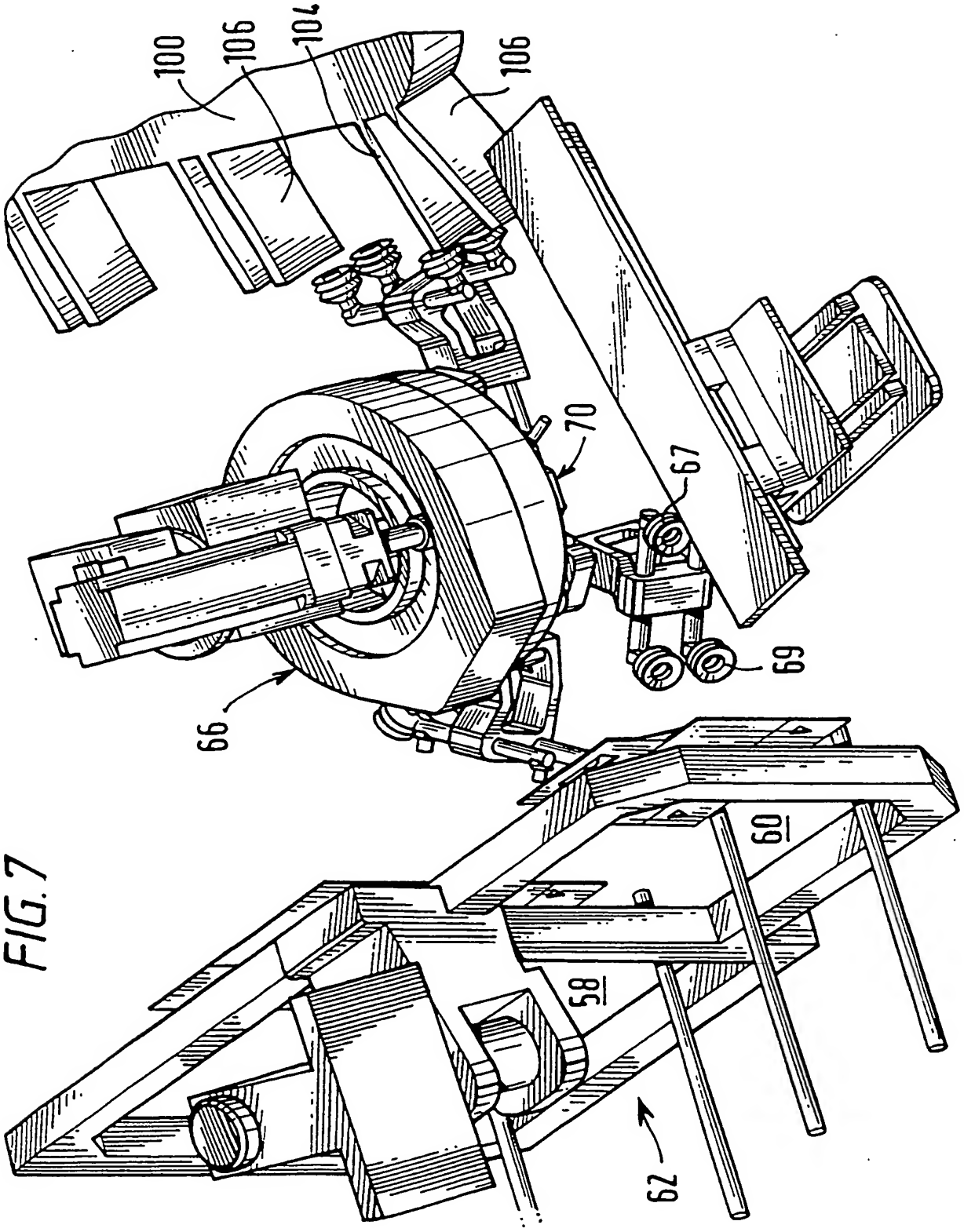


FIG. 7

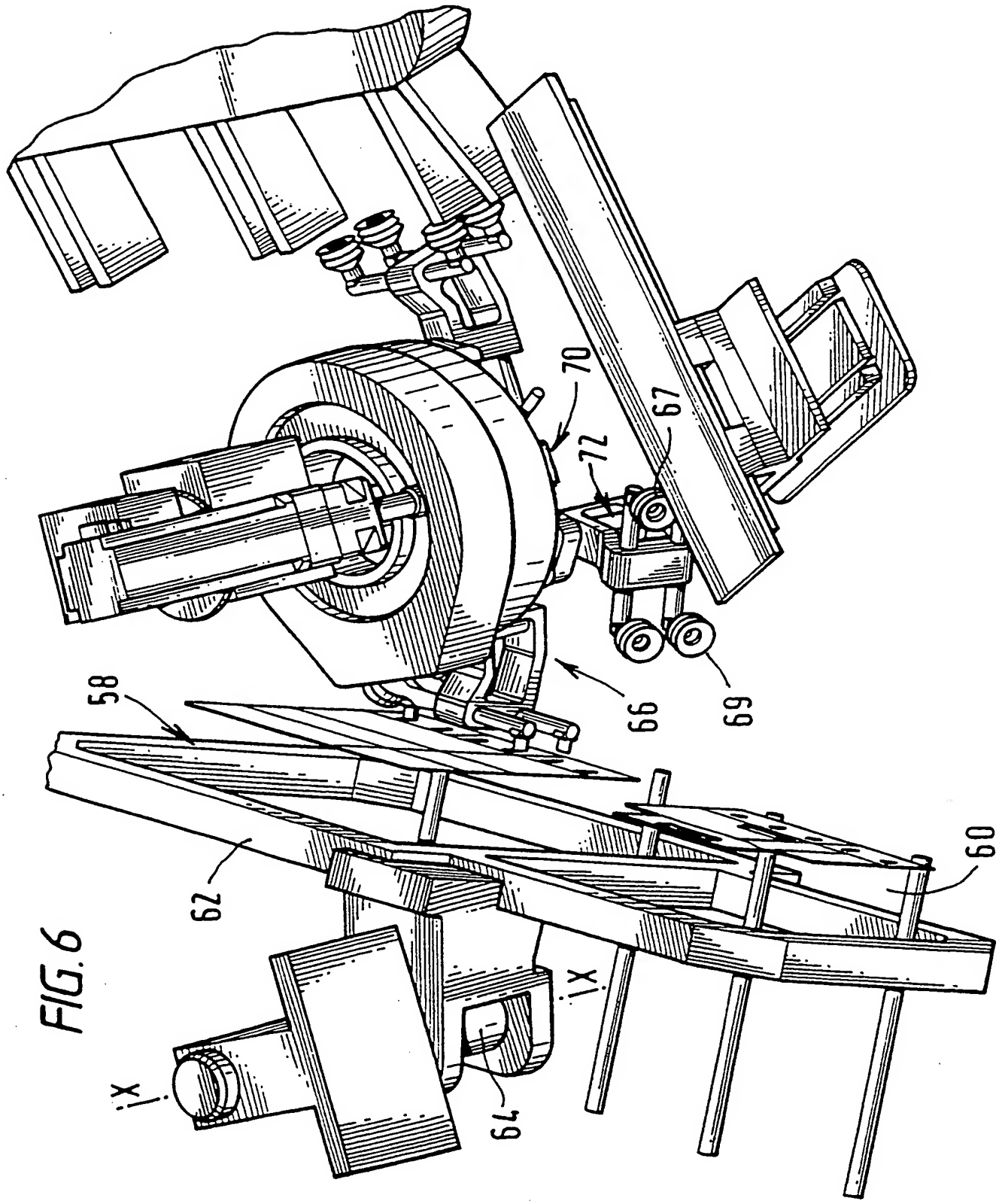


FIG.6

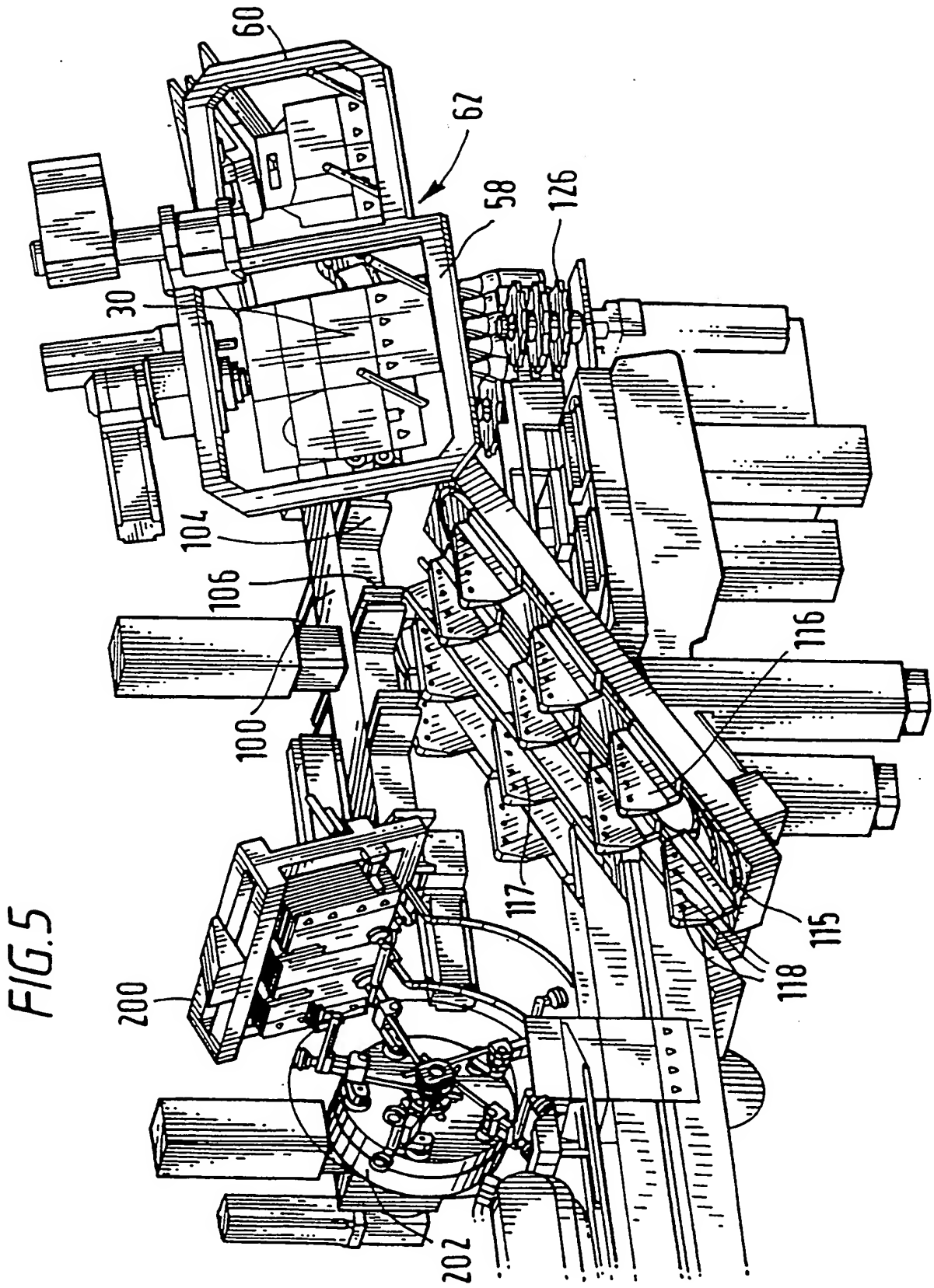


FIG.5

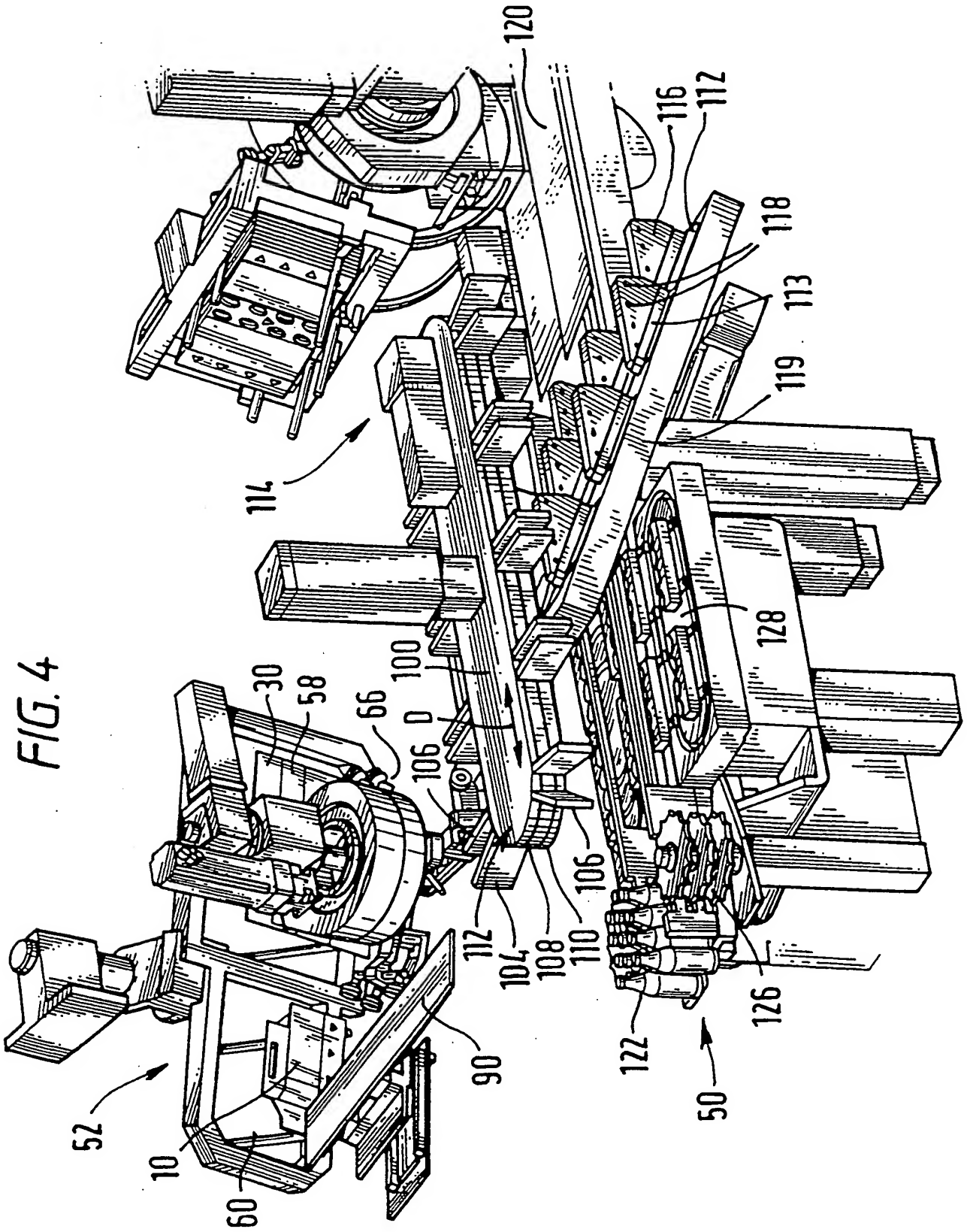

120
116
112
118
113
119
114
128
100
30
58
66
D
106
106
112
104
108
110
126
122
50
90
52
10
60

FIG. 4

FIG.3a

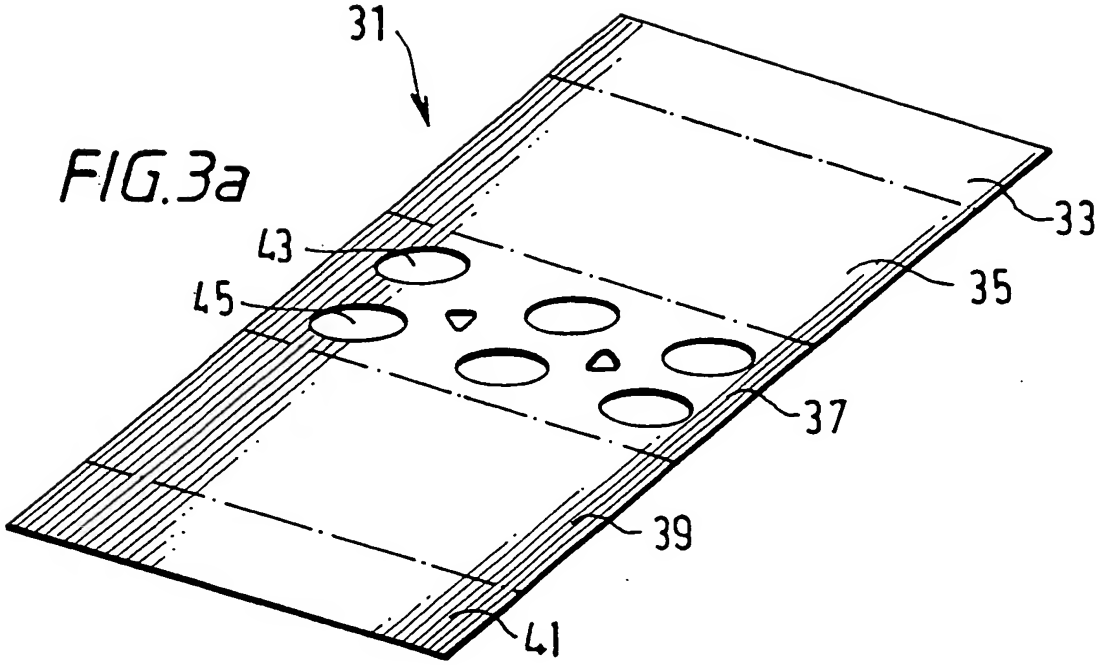


FIG.3b

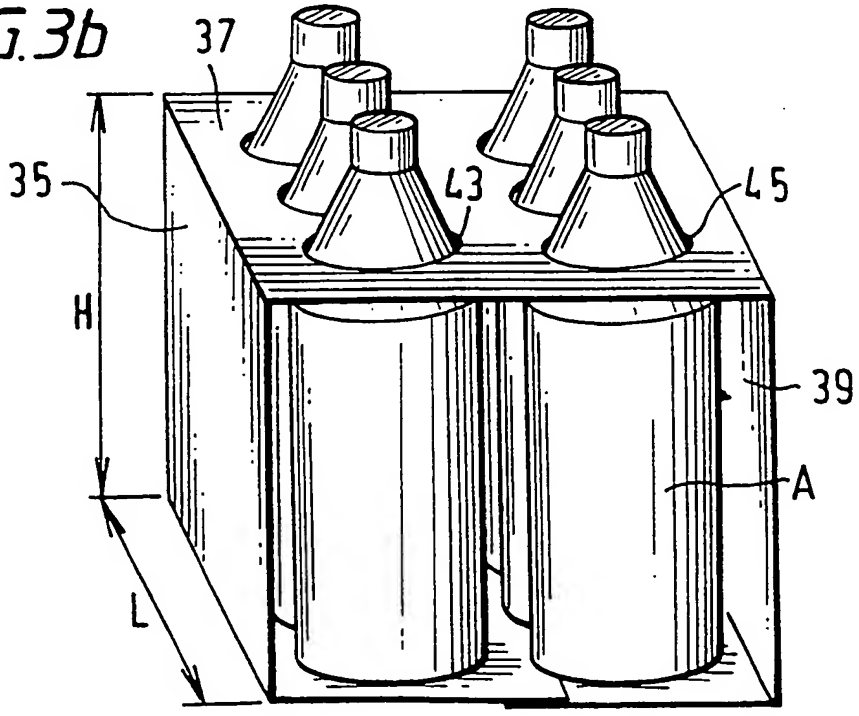


FIG. 2a

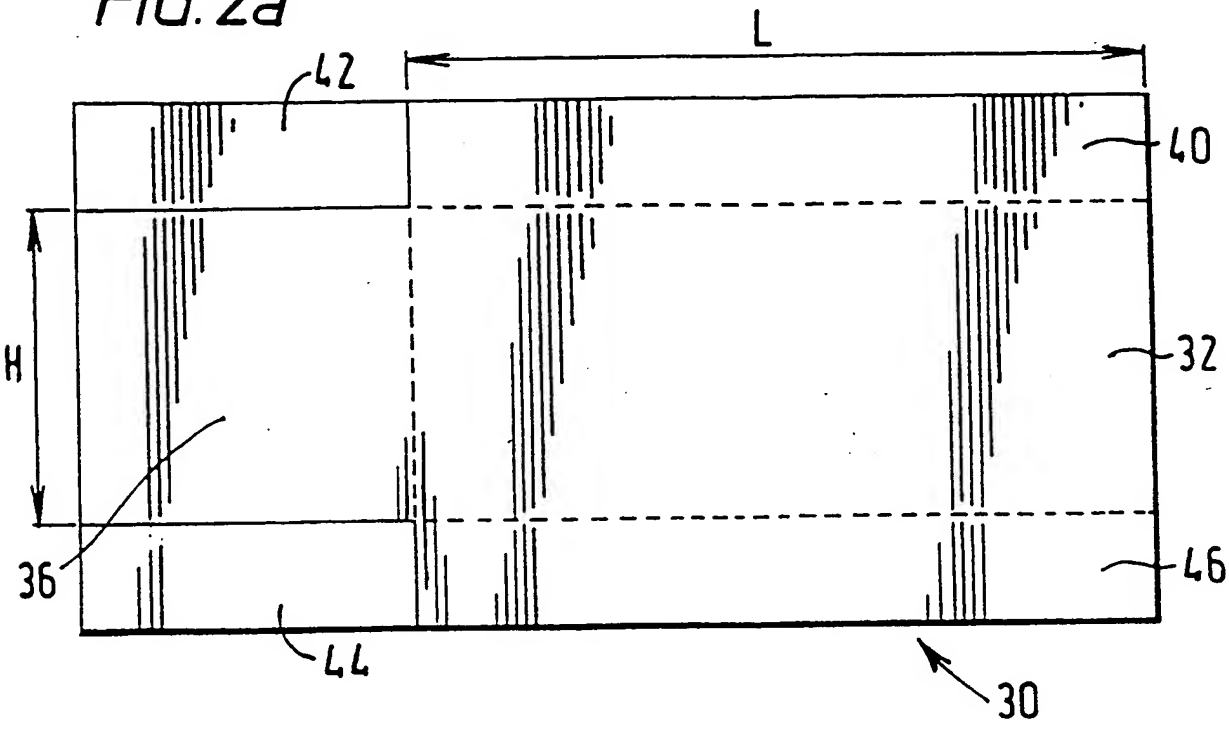
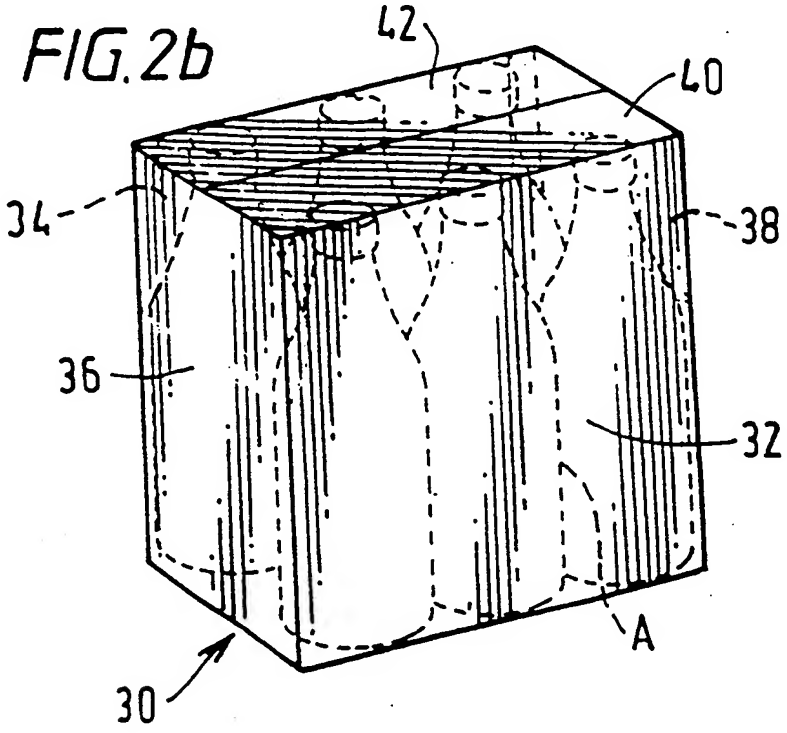


FIG. 2b



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 98/19606

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B65B 5/02, B31B 5/80, B65B 21/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B65B, B31B, B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4089150 A (HEISLER), 16 May 1978 (16.05.78), column 2, line 41 - line 44; column 2, line 55 - line 58; column 5, line 49 - line 63, column 6, line 32 - line 51, column 15, line 25 - line 45	1-33
A	US 4735600 A (DREWKE ET AL), 5 April 1988 (05.04.88), abstract	1-33
A	US 2909874 A (C.L. BARR), 27 October 1959 (27.10.59)	1-33

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 January 1999	02.02.99
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+ 31-70) 340-3016	Authorized officer Kristina Peterson

INTERNATIONAL SEARCH REPORT

Int ational application No.
PCT/US 98/19606

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 1568126 A (THE MEAD CORPORATION), 29 May 1980 (29.05.80)	1-33

INTERNATIONAL SEARCH REPORT

209534

Information on patent family members

01/12/98

International application No.
PCT/US 98/19606

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4089150 A	16/05/78	CA 1077900 A	20/05/80
		GB 1586005 A	11/03/81
		JP 53145798 A	19/12/78
US 4735600 A	05/04/88	DE 3606093 A	27/08/87
		DE 3773226 A	31/10/91
		EP 0234228 A,B	02/09/87
		JP 62208330 A	12/09/87
US 2909874 A	27/10/59	NONE	
GB 1568126 A	29/05/80	AU 509202 B	24/04/80
		AU 3010977 A	03/05/79
		CA 1062214 A	11/09/79
		CA 1064297 A	16/10/79
		DE 2748081 A	24/05/78
		FR 2370639 A,B	09/06/78
		FR 2542699 A,B	21/09/84
		GB 1568127 A	29/05/80
		JP 53063193 A	06/06/78
		NL 7711921 A	17/05/78
		US 4081945 A	04/04/78